Express Mail #EV287633432US
Attorney Docket 27383 USA

PIPE PREPARATION DEVICE

Field of the Invention

This invention concerns tools for preparing pipes for joining to one another, and especially for pipes joined using mechanical pipe couplings.

Background of the Invention

Pipes, especially relatively small diameter copper pipes between one half inch and two inches nominal diameter, are used extensively to provide water service for homes, business and industry. Such pipes may be sealingly joined to one another end to end using mechanical couplings to create a piping network for conveying water throughout a building such as a home, office or factory.

Mechanical couplings provide various advantages over traditional solder joints for connecting pipes in that they avoid the use of acid flux, solder and open flame to effect a connection. Assembly of a joint using a mechanical coupling also requires less time than a solder joint and may be performed by a less skilled worker. Assembly of a joint merely requires

that a pipe end be inserted into a coupling so that the coupling and pipe end engage properly.

The mechanical coupling, which may be a fitting such as an elbow, tee or straight fitting, for example, includes a housing having a socket coaxially aligned with a receptacle for receiving the pipe end. A sealing member, such as an O-ring or a pressure responsive seal and a retainer are captured within the receptacle adjacent to the socket. The retainer may have a plurality of flexible teeth that extend around the circumference of the receptacle. The teeth project radially inwardly and are angularly oriented toward the socket. When the pipe end is inserted through the receptacle and into the socket, the teeth engage the pipe's outer surface and retain it within the coupling. Due to their angular orientation, the teeth are "self jamming" and resist motion of the pipe that would tend to force it from the receptacle. The sealing member within the receptacle engages the pipe and the housing to provide a fluid-tight seal, and the socket supports the pipe and provides bending stiffness to the joint, preventing angular deflection between the pipe and the coupling.

To ensure an effective, fluid-tight joint, the pipe end must be properly seated within the coupling so that it engages the socket over a sufficient length to insure that the full stiffness of the joint is achieved and so that the sealing member and the pipe outer surface engage and seal relatively to one another. Furthermore, the teeth of the retainer must engage the pipe end to ensure that it is retained within the coupling against the fluid pressure it will eventually

see. However, without a visible means to indicate proper engagement of the pipe end with the mechanical coupling it is difficult to be sure that the joint formed will be fluid tight and sufficiently inserted to maximize bending stiffness and strength of the joint. Visible indicators may take the form of "witness marks", typically circumferential grooves or other visible markings that extend around the pipe in spaced relation to the end. The witness mark is positioned, for example, such that if it is not positioned visible and flush next to the coupling, then the pipe end is not properly engaged with the coupling and must be further inserted until the witness mark is visibly flush with the coupling. It is advantageous to provide a device that will prepare pipe ends for joining with mechanical couplings, for example, by forming one or more witness marks in proper spaced relation to an end of a pipe for a particular coupling and diameter pipe.

Summary of the Invention

The invention concerns a device for preparing ends of pipes for joining the pipes to one another end to end, preferably although not exclusively using mechanical couplings. The device comprises a body having a receptacle therein sized to receive the end of one of the pipes. One or more tools are mounted on the body and are positioned so as to engage the pipe upon insertion of the pipe within the receptacle. The tools may comprise, for example, a marking tool mounted on the body. The marking tool has a contact surface engageable with the pipe for creating a witness mark, for example, a circumferential groove around the pipe upon rotation of the body and the pipe relatively to one another. A second marking tool may also be mounted

on the body. The second marking tool is preferably offset from the first marking tool in a direction lengthwise along the pipe. The second marking tool has a second contact surface positioned so as to engage the pipe upon insertion of the pipe within the receptacle. Together, the first and second marking tools create first and second witness marks on the pipe upon rotation of the body and the pipe relatively to one another.

In addition to or instead of the marking tools, a cutting blade may be mounted on the body. The cutting blade has a cutting edge that extends into the receptacle and is positioned to engage the end of the pipe received therein. The cutting edge is oriented relatively to the pipe so as to create a chamfer on its end upon rotation of the body and the pipe relatively to one another.

The device may also include additional receptacles positioned within the body. The additional receptacles are sized to receive the end of one of the pipes and also have one or more tools mounted and positioned so as to engage the pipe upon its insertion within the additional receptacles. The tools associated with the receptacles may also be marking tools and cutting blades substantially as described above for the first receptacle. Preferably, when two receptacles are present, the first and second receptacles are substantially coaxially aligned with one another and are sized to receive pipes of different diameters. Furthermore, an elongated shaft may be mounted on the body. Preferably, such a shaft has a polygonal cross-section (preferably hexagonal). When mounted, the

shaft is oriented substantially coaxially with the receptacles and is engageable with a chuck or a compatible extension shaft such as used with a rachet wrench, power drill or other powered device. The presence of the shaft allows the body to be rotated relatively to the pipe upon rotation of the shaft by the drill or other powered device. Preferably, the shaft extends substantially coaxially through both the first and the second receptacles allowing the body to be turned from either end.

The device may also accommodate a separate marking tool for placing a witness mark on ends of pipes. The device preferably comprises a body having a receptacle therein sized to receive the end of one of the pipes, and an aperture extending through the body and into the receptacle. The aperture is adapted to receive the marking tool, which could be a writing implement such as a pen, pencil or marker or a stylus with a hardened tip for scoring the pipe surface. The marking tool is insertable through the aperture and into the receptacle for the pipe end received therein. The marking tool is adapted to create a witness mark on the pipe upon rotation of the body and the pipe relatively to one another.

Brief Description of the Drawings

Figure 1 is a perspective view of a pipe preparation device according to the invention;

Figure 1A is a perspective view of pipe ends prepared using the device of Figure 1;

Figure 2 is an exploded perspective view of the pipe preparation device;

Figure 3 is a plan view of the pipe preparation device;

Figure 4 is a longitudinal sectional view taken at line 4-4 of Figure 3;

Figure 5 is a cross-sectional view taken at line 5-5 of Figure 3;

Figure 5A is a cross-sectional view taken at line 5A-5A of Figure 4;

Figure 6 is a cross-sectional view taken at line 6-6 of Figure 3;

Figure 6A is a cross-sectional view taken at line 6A-6A of Figure 4; and

Figure 7 is a plan view of an alternate embodiment of the pipe preparation device according to the invention.

Detailed Description of the Embodiments

Figure 1 shows pipe preparation device 10 according to the invention. Device 10 comprises a body 12 having receptacles 14 and 16 at opposite ends. Preferably, receptacles 14 and 16 are coaxially aligned with one another and are sized to receive pipes 18 and 20, shown in Figure 1A, the pipes preferably having different diameters from one another. As body 12 must be turned relatively to the pipes 18 and 20 to effect

their preparation, it is convenient to provide radially projecting ribs 22 to facilitate manual grasping and rotating of the device 10. Body 12 is preferably formed from durable polymer resin to provide a light-weight, inexpensive and robust item that can withstand rough use.

Figure 2 provides an exploded view that illustrates the various tools mounted on the body 12 that engage the pipe during its preparation. A cutting blade 24 is mounted on a ledge 26 formed adjacent to an aperture 28 that opens into receptacle 14. As best shown in Figure 3, the blade 24 has a cutting edge 30 that extends into the receptacle 14 to engage the end of pipe 18 inserted into the receptacle. Cutting edge 30 is oriented or shaped so that it cuts a chamfer 32 on the end of pipe 18 when the pipe and body are rotated relatively to one another. It is also contemplated that the cutting edge 30 may be used so as to form a radius or other shape on the pipe end. Shavings from the pipe are discharged from aperture 28. Chamfering the pipe end removes burrs or other irregularities caused by cutting of the pipe stock and also provides a lead-in that facilitates insertion of the pipe end into a coupling. Chamfering reduces insertion force required to deflect typical retainers and seals and also prevents or reduces the potential for damage to the seals. To ensure a proper chamfer, the cutting edge 30 is positioned so as to engage the pipe 18 at its center line as illustrated in Figure 5. Preferably, the cutting blade 24 is removably mounted on ledge 26 using a fastener 34, allowing the blade to be readily replaced when it becomes dull. Preferably, cutting blade 24 has multiple cutting edges 30. This

feature permits another cutting edge 30 to be indexed into the cutting position extending through aperture 28 as one edge becomes dull without replacing the blade 24, the blade merely being removed, rotated and secured back into position using fastener 34. As shown in Figures 3 and 6, a second cutting blade 36 is positioned on a second ledge 38 positioned adjacent to a second aperture 40 that opens into the other receptacle 16. The second cutting blade 36 forms a chamfer 32 on pipe 20 (see Figure 1A) when this pipe is engaged within receptacle 16. Again, the cutting blade 36 is removably mounted using a fastener 42 and positioned to engage a pipe inserted into receptacle 16 along the pipe center line.

As further shown in Figure 2, a plurality of marking tools 43 are mounted on the body 12. Marking tools 43 are adapted to form witness marks on the pipes and preferably take the form of scoring tools 44a, 44b, 46a and 46b. Each scoring tool is received within a respective opening 48a, 48b, 50a and 50b, the openings extending into one of the two receptacles 14 and 16 as shown in Figure 4 to position two scoring tools within each receptacle. Preferably, each scoring tool includes a threaded cylinder 52, the openings 48a, 48b, 50a and 50b being tapped with compatible threads to allow the scoring tools to be removed and replaced.

Each scoring tool has a contact surface 54 preferably comprising the surface of a ball 56 that is positioned at the end of each cylinder 52. Springs 58 within each cylinder 52 bias balls 56 so that they project outwardly from each cylinder and into the receptacle in which the scoring tool is mounted.

Preferably, the balls are captured within the cylinders, for example by staking.

As best illustrated for receptacle 14 in Figure 4, the scoring tools 44a and 44b are offset from one another by a distance 60 in a direction lengthwise along pipe 18. Thus, when the pipe 18 is inserted within receptacle 14, and the body 12 and pipe 18 are rotated in opposite directions relatively to one another, the balls 56 in each scoring tool 44a and 44b engage the pipe 18 and form circumferential grooves 62 and 64 (see also Figure 1A). The grooves are offset from one another as determined by the offset distance 60. Scoring tools 46a and 46b in receptacle 16 are also offset and will form offset grooves 66 and 68 around pipe 20 as shown in Figure 1A when it is engaged within receptacle 16. Balls 56 are preferably made of stainless steel to prevent corrosion and may be hardened as required so that they effectively cold-work the pipe material to form the grooves.

Figures 1, 5A and 6A illustrate an alternate marking tool 45 that is not mounted on the body 12. Instead, body 12 has an aperture 47 adapted to receive marking tool 45, the tool being insertable through the aperture and into the receptacle 16. Upon insertion, as shown in Figures 5A or 6A, marking tool 45 is engageable with a pipe 32 and will form a witness mark on the pipe when the pipe and the body are rotated relatively to one another.

The marking tool 45 may comprise, for example, a writing implement, such as a pen, a pencil, a marker or other item that will place a line or other indicia on

the surface of the pipe 32. Tool 45 may also comprise a stylus with a tip 49 adapted to score the surface of the pipe 32 and form a circumferential groove therein. The tip may be, for example, a diamond, a hardened ball, a blade, or other item that will score the surface of the pipe to form a groove. As shown in Figures 5A and 6A, apertures 47 may be positioned in each end of body 12 so that each receptacle 14 and 16 may be used with a marking tool 45 to form witness marks.

As shown in Figures 2 and 4, it is advantageous to position a shaft 70 coaxially within receptacles 14 and 16 to facilitate rotation of the body 12 when preparing pipes. Shaft 70 is held in position by metal split pins 72 and 74 that extend through holes 76 and 78 in body 12. Holes 76 and 78 align with holes 80 and 82 in the shaft 70 when the shaft is properly positioned within the body 12. As shown in Figure 4, split pins 72 and 74 extend into receptacles 14 and 16 and act as stops that engage the pipes (as illustrated by pipe 14) and prevent them from gouging the body 12 within the receptacles. Shaft 70 preferably projects into both receptacles 14 and 16 to allow a power drill 84 (shown in broken line) to be applied to either end of the device to spin the body 12 when preparing a pipe. Preferably, the shaft 70 has a polygonal cross sectional shape, such as a hexagon. The polygonal shape allows the shaft 70 to be engaged by an adapter 71 that can be turned by a drill 84 (see Figure 4) or other tool such as a rachet wrench. Alternately, as shown in Figure 7, shaft 70 may extend outwardly from one or both of the receptacles 14 and 16 of body 12 to

directly engage the drill 84 or other tool that turns it.

As illustrated in Figure 1A, pipes 18 and 20, having different diameters, may be prepared using device 10. Preferably, each of the pipes has two grooves that function as witness marks (62 and 64 for pipe 18, and 66 and 68 for pipe 20) that indicate when a pipe is properly engaged with a pipe coupling. When properly engaged, one of the grooves (64, 68) is not visible, it being positioned within the coupling, and the other groove (62, 66) is visible adjacent to the end of the coupling providing an indication that the pipe was marked. It is advantageous to be able to ascertain that the pipe was marked so that proper engagement of pipe and coupling can be visually verified. The chamfer 32 at the ends of the pipes provides a lead-in to facilitate entry of the pipe into the coupling.

The pipe preparation device according to the invention provides a versatile item useful for preparing pipes for engagement with mechanical pipe couplings, the device being usable on more than one diameter pipe.